rotation of a fly-wheel. Replacing the porous pots by a transpiring branch, this too maintains the wheel in rotation. This is, in fact, a vegetable engine. In short, the transpiration effects going on at the leaf are, in so far as they are the result of spontaneous evaporation and uninfluenced by other physiological phenomena, of the "sorting demon" class, in which the evaporating surface plays the part of a sink of thermal energy.

If the tensile stress in the sap is transmitted to the root, the authors suggest that this will establish in the capillaries of the root-surface meniscuses competent to condense water rapidly from the surrounding soil. They show by experiment the power possessed even by a root injured by lifting from the soil, of condensing water vapour from a damp atmosphere. Such a state of things may be illustrated by a system (which the authors realised) consisting of two porous pots connected by a tube and all filled with water; one, the "leaf," exposed to the air gives out vapour, the other, the "root," buried in damp earth supplies the demand of the "leaf," and an upward current in the connecting tube is established.

III. "The Pigments of the Pieridæ. A Contribution to the Study of Excretory Substances which function in Ornament." By F. GOWLAND HOPKINS, Demonstrator of Physiology and Chemistry at Guy's Hospital, London. Communicated by Professor E. RAY LANKESTER, F.R.S. Received October 5. 1894.

(Abstract.)

The paper deals with the chemistry of the wing pigments of that group of butterflies known as the Pieridæ, and demonstrates the excretory nature of these pigments. The following are the salient facts dealt with, most of the statements being based on original observations described in the paper:—

1. The wing scales of the white Pieridæ are shown to contain *uric acid*, this substance bearing the same relation to the scale as do the pigments in the coloured Pieridæ, and therefore functioning practically as a white pigment.

2. The yellow pigment which is so widely distributed in the Pieridæ (being found in the majority of the genera) is shown to be a derivative of uric acid.

3. The properties of this yellow pigment are described, and the results of its analysis are given. The pigments of various yellow-coloured genera are shown to be identical.

4. It is shown that this yellow pigment may be artificially produced by heating uric acid with water in sealed tubes at high tem-

peratures. The product so obtained was originally described by Hlasiwetz as "mycomelic acid"; but evidence is brought forward to show that the substance described and analysed by this chemist was in reality urate of ammonium coloured by a yellow body, probably identical with the natural pigment.

5. The identity of the natural and artificial products is demonstrated by the fact that both yield under like treatment a purple derivative, which has a well-marked and easily identified absorption spectrum.

6. The artificial yellow product has not yet been obtained in a pure condition, but it may be so far purified as to exhibit clearly all the general properties of the natural pigment.

7. The natural pigment as prepared for analysis is shown to be almost certainly a chemical individual. Its probable constitution is discussed.

8. It is shown that this yellow substance (denominated in the paper "Lepidotic acid"), together with a closely allied red substance, will account for all the chemical pigmentation of the wing scales of the coloured Pieridæ, though modifications may be produced by superadded optical effects. The black pigment found in the group is not dealt with in the paper.

9. The described uric acid derivatives, though universal in the Pieridæ, are apparently confined to this group among the Rhopalocera. This fact enables the interesting observation to be made, that where a Pierid mimics an insect belonging to another family, the pigments in the two cases are chemically quite distinct. This is well seen in the genera *Leptalis* and *Mechanitis* respectively.

10. The existence of pigments other than scale-pigments is for the first time described; substances, namely, which are found between the wing membranes, and which, in certain genera, are the basis of ornament.

11. The fact that the scale-pigments are really the normal excretory products of the animal utilised in ornament, is emphasised by the observation that the yellow Pierids, on emergence from the chrysalis, are apt to void from the rectum a quantity of uric acid coloured by a yellow substance which exactly resembles the pigment of the wing.

Presents, November 15, 1894.

Transactions.

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